

6. That if used subcutaneously in too concentrated a form it will produce local irritation and swelling. The strength recommended for subcutaneous injection in human practice is from 1 in 600 to 1 in 200, and certainly in veterinary patients this should not be exceeded.

7. That the cat is very susceptible to its action, and that in this animal much more care is necessary to guard against toxic symptoms than in the case of the dog. In the cat, if subcutaneously injected, the extreme limit of dose should be one-sixteenth of a grain for each lb. body weight, and in the dog one-eighth of a grain per lb.

8. That chinisol is not rapidly absorbed from the unbroken skin of the dog, and can be applied for several days in succession even in fairly concentrated solutions to the skin of this animal without producing eruptions or sores.

9. That the chief symptoms of poisoning are: Sneezing and coughing, an increased flow of thick ropy saliva; subnormal temperature; staggering gait, commencing with loss of motor power in the hind quarters; great prostration, and ultimately death from failure of the heart's action.

10. That the chief *post-mortem* characteristic is the smell of chinisol on or in some part of the body; whilst another symptom to be looked for is the presence of frothy saliva in the pharynx, œsophagus, or stomach.

INFECTIVE VENEREAL TUMOURS IN DOGS.¹

By G. BELLINGHAM SMITH, M.B., B.S., and J. W. WASHBOURN, M.D.

SINCE the beginning of the year 1896 we have had under observation a series of contagious tumours on the genital organs of dogs. The contagium is conveyed in the act of coitus, and the tumours are in this respect comparable to the venereal tumours met with in man. This series seems to us worthy of putting on record, not only from the light it throws upon the ætiology of venereal tumours, but also as a slight contribution to the general question of the infective nature of tumours.

History of Infection.—From January to June 1894, a dog, A, served twelve bitches, eleven of whom became infected. About a month after pupping there was noticed in each case a growth in the vaginal wall, somewhat resembling a raspberry. The growth gradually increased in size and extent, until in some cases the whole of the vagina was filled with a mass as large as an orange.

An examination of the dog A revealed the presence of a similar growth, situated on the penis behind the corona.

The bitches were of various ages, the younger being less severely affected than the older. The oldest were very severely affected, and had to be killed.

Constant bleeding from the vagina was in every case the symptom which led to the detection of the growth. In none of the cases was there any antecedent purulent discharge.

Every bitch affected was operated upon by veterinary surgeons for the removal of the growths. Four (Nos. 1, 2, 3, and 4) were temporarily cured, but the growth reappeared after pupping. Further

¹ Reprinted from the "Transactions of the Pathological Society of London," vol. xlvi., 1897.

treatment in these cases has resulted in a permanent cure. Three (Nos. 5, 6, and 7), the oldest and most severely affected, were killed.

A rough *post-mortem* examination was made in one case by the owner of the dogs. He states that the vagina was full of growth, which extended up into the uterus, forming a mass noticeable on opening the abdomen. In another case, in which the abdomen was opened by a veterinary surgeon in the presence of the owner, the latter observed that the peritoneum was studded with small growths.

On 13th January 1896, we examined four of the bitches (Nos. 8, 9, 10, and 11) which were still affected with vaginal growths. One of these (No. 8) had been under treatment for eighteen months, and showed slight improvement as the result of local and general treatment.

A dog, B, which had served the affected bitches (2, 10, and 11), was found on 22nd December 1895, to have what the owner described as a collar chancre about $\frac{1}{4}$ -inch wide, entirely surrounding the penis just behind the corona. This growth increased in size, and when seen by us on 19th March 1896, presented the same character as the growths affecting the bitches.

This dog had served two healthy bitches before the growth on the penis was noticed. One of the bitches (No. 12) came in pup, and developed a growth similar to those observed in the others of the series. The other bitch did not come in pup, and was not affected.

Shortly, then, we have the following history of infection. Of twelve bitches, served by a dog suffering from a growth on the penis, eleven became affected with similar growths in the vagina. Three of these bitches were served by a second dog, who subsequently developed a growth on the penis. After becoming infected, this second dog served two healthy bitches. One of these bitches developed a growth in the vagina, but the other remained unaffected.

All the dogs were the property of one owner. There was consequently no difficulty in obtaining an accurate history, and no doubt whatever about the source of infection in every case. On account of the value of the dogs, the owner has naturally taken great interest in the matter, and he has given us every facility for carefully examining the animals on many occasions. We are not at liberty to publish the name of the owner, nor to mention the breed of the dogs.

In addition to the above series we have seen five bitches of another breed affected with similar growths. The tumours developed after the bitches were served by a certain dog, which we have unfortunately had no opportunity of examining. One of these bitches was subsequently served by another dog; and, in spite of every precaution being taken in the way of frequent washing of the penis after coitus with antiseptic lotions, a number of small growths made their appearance upon the penis. The growths in this series were exactly similar to those in the first series.

Description of Tumours.—The growths are either single or multiple, and frequently many small tumours are found at an early stage. Even when single at the commencement, infection of other parts of the mucous membrane often takes place by the time the tumours have reached the size of a mulberry.

A common situation for the tumours in the bitch is the neighbourhood of the urethral orifice; and on several occasions we have

removed single growths from this situation. In other cases they occupy some portion of the vestibule,¹ or lie just within the vulval outlet. In one case we excised a growth the size of a mulberry from the posterior margin of the vulval orifice. When the growths are large and multiple they may completely fill the vagina, and they may extend upwards beyond the reach of the finger. These large masses often protrude from the vulva and distend the perineum.

The dog B had a pinkish, rather firm lobulated mass, from half to three quarters of an inch broad, entirely surrounding the penis behind the corona. There were, in addition, a few small growths on the glans.

In the majority of the cases we examined the growths were already of some months' duration. They then usually appear as lobulated masses, slightly constricted at the base, and of a pink or purple colour. The lobulation is sometimes coarse, sometimes fine, but the indentations are never deep. The tumours vary in consistence, being sometimes soft, sometimes firm, but never hard. As a rule, they readily bleed on manipulation by the time they have reached the size of a mulberry. On section the larger growths present a uniform whitish surface, moderately firm in consistence.

In one case we found a firm growth, about one and a half inches in diameter, almost completely smooth on the surface, hanging from the vaginal wall by a flattened pedicle, less than half an inch in its broadest diameter. This growth was microscopically identical with the lobulated sessile growths.

In another case (*see* Fig. 1) we were able to watch the progress of the disease on the penis of a dog from its commencement.



FIG. 1.

Within a week of infection the growths appeared as small glistening elevations, about the size of millet seeds, mostly transparent, but sometimes blood-stained. They looked like vesicles, but on pricking they

¹ The vestibule in the bitch is large, the urethral orifice being situated some distance from the vulval outlet.

proved to be solid. One was removed, and on microscopical examination showed the same structure as the more advanced growths. At the end of two months they were still small, but were more solid in appearance. At the end of six months two of the growths had considerably increased in size, and were about half an inch in diameter, while the remainder had disappeared. In a year the growths had



FIG. 2.

Case of bitch first seen in August 1896. The vagina has been cut open, and three nodules of growth are seen in the vestibule. The rod is placed in the orifice of the urethra. The vagina above the urethral orifice is free from growth. (From a drawing by Dr T. G. Stevens.)

further increased in size, and had assumed the usual lobulated appearance.

In the majority of cases there was no deep induration, and the growths were readily removed from the subjacent structures with the mucous membrane to which they were attached. In two cases in

which we had an opportunity of making a *post-mortem* examination there was infiltration of the deeper tissues.

The first case was that of a bitch which was first seen by us in January 1896, when the vagina was filled by a large mass of growth which distended the perinæum. In August the growth had diminished in size, and presented at the vaginal orifice as a firm, warty, irregular mass, exactly resembling a malignant tumour. The perinæum was partially destroyed, and the vulval outlet was represented by an irregular opening, one and a half inches long and one and a quarter inches broad, with hard everted edges. In December the opening was two inches long and one and a half inches broad, and the growth had extended in the subcutaneous tissue for about an inch from the margin of the orifice as a firm nodular mass, more or less adherent to the overlying skin. The animal succumbed some days after an operation for the removal of the growth. At the *post-mortem*

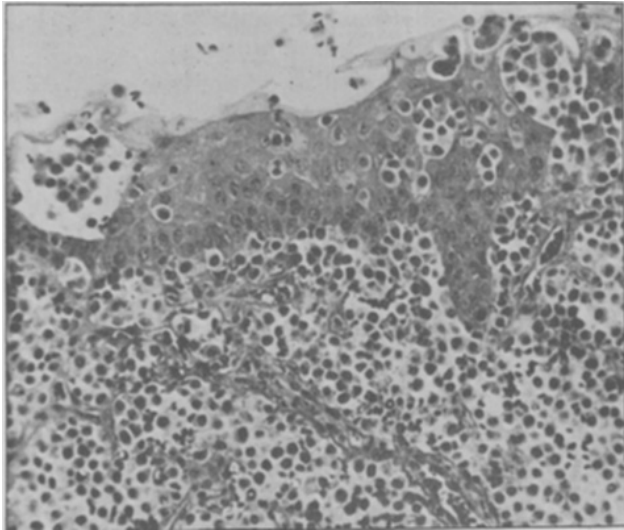


FIG. 3.

Section through one of the tumours. On the surface the epithelial lining of the mucous membrane is seen; the mass of the growth is composed of cells with round nuclei, enclosed in irregular alveolar spaces.

examination the kidneys were found to be affected with interstitial nephritis, and no secondary growths were found. The tumour was carefully examined, and it was found to have infiltrated the vaginal wall. It had the same microscopical structure as the other growths.

The second case was that of a bitch which was first seen by us in August 1896, when there was a growth about an inch in diameter close to the urethral orifice, apparently similar to the growths in the other dogs. In October of the same year she succumbed to puerperal septicæmia, shortly after pupping. At the *post-mortem* examination we found, on the left of the urethral orifice, an irregular mass, one and a half inches in diameter, torn and ragged in the centre as if injured during parturition. On cutting through the base of the tumour

it was seen to extend deeply as a firm, whitish, lobulated, well-defined growth, which infiltrated the muscular wall, and which could not be shelled out. Two rounded tumours, half an inch in diameter, were found beneath the mucous membrane of the vestibule, near the vaginal orifice. Over each of these there was a slit in the mucous membrane, through which a small mass of growth fungated. These tumours had been noticed about two months before death, and they had been shelled out through incisions made in the mucous membrane; but they had recurred, and had fungated through the incision. On section the masses were found to infiltrate the vaginal wall. They were round, yellowish-white in colour, with a well-defined outline. Although encysted, the growths could not be completely shelled out. The glands in the groin were enlarged. No secondary deposits were found in the viscera.

The dog which served this bitch became infected with a number of small growths on the penis. These we removed, and on microscopical examination they were found to be similar to the rest of the growths. Up to the present no recurrence has occurred.

Microscopical Appearances of the Growths.—Covering the free surface of the tumours is a layer of stratified epithelium, continuous with and similar to that lining the vagina. The epithelial layer is frequently thinned out, but is never absent. Corresponding to the slight indentations between the lobules, the epithelium dips in for a short distance. The epithelium is separated from the subjacent tissue by a layer of connective tissue, sometimes very delicate, but always demonstrable by appropriate staining methods.

The main mass of the growth is made up of cells, which are very regular in size, and possess round nuclei. In some of the tumours—apparently the more rapidly growing ones—the cells are loosely packed, preserving their rounded forms. In others they are closely packed, and assume a polyhedral shape, giving at first sight the impression of an epithelial new formation. This is especially the case in those growths where the stroma is relatively large in amount, and encloses the cells in irregular alveolar spaces.

The stroma varies considerably in amount in different growths. In some, especially in those which are increasing rapidly, it is very scanty; in others it is relatively well marked. The alveolar arrangement mentioned above is especially marked just beneath the surface epithelium, the general structure and appearance being very similar to the alveolar sarcomata of the skin in the human subject.

Numerous small thin-walled blood-vessels may be seen, not only in the supporting framework, but also between the cells.

In the two cases in which the growths infiltrated the vaginal wall and the perineum the structure was identical with that just described.

So far as the structure is concerned the growths are to be regarded as sarcomata. They differ entirely from the venereal tumours met with in the human subject, which result mainly from an epithelial overgrowth.

Dr Plimmer kindly examined some of the tumours, and was unable to demonstrate with certainty the presence of the protozoa described by himself and Professor Ruffer in malignant tumours.

We have hitherto failed to find any micro-organisms which we can claim to bear a casual relation to the tumour. We hope, how-

ever, to make further observations in these directions at a later date.

Secondary Deposits.—We have found no secondary deposits in the viscera; but our *post-mortem* examinations have been limited to two cases, in neither of which has the animal died from the direct effect of the disease. The owner of the dogs, however, informs us that in one case he noticed tumours on the peritoneum after death.

In one case we found the inguinal glands enlarged. Microscopical examination showed that they were infiltrated with groups of cells, similar in size and shape to those of the primary growth.

Course taken by the Tumours.—We have in no case observed a spontaneous cure. The growths have always gradually increased in size, and fresh tumours have appeared on the vaginal wall, or on the penis. The owner thinks that this occurs especially after hæmorrhage caused by manipulation, and after unsuccessful attempts at removal. The rate of growth is slow at first, but becomes more rapid at a later period, so that by the end of a year or eighteen months the vagina is completely filled by a mass as large as an orange.

In the early stages the growths are confined to the mucous membrane, and do not infiltrate the deeper parts. In the course of time, however—perhaps some two or three years from the commencement of the attack,—infiltration of the deeper parts takes place. In the highly bred class of dogs under our notice there seems to be a tendency for the growths—originally simple in character—to take on a malignant course, leading directly or indirectly to death.

The Relationship of the Growths to Discharge.—The dependence of venereal warts in man upon the continued irritation or venereal discharge has for a long time been a prevailing belief, and we find that a similar view is held by some veterinary surgeons with regard to the causation of papillomatous growths on the genitals of dogs (*e. g. vide* Kitt).

Recently C. W. Cathcart¹ has brought forward evidence to show that venereal warts in man may be conveyed independently of a gonorrhœal or syphilitic discharge. He believes that venereal warts are specific and contagious, and that they are associated with, but not dependent upon venereal discharge.

We have gone carefully into this question in the case of the dogs, and we feel quite certain that the tumours are not dependent upon irritation due to discharge.

When the dogs were first brought under our observation we noted especially the fact that, with the exception of the cases which were being treated with caustic, there was an absence of purulent discharge. The growths, however, which we first examined were of large size, and we thought that there might have been an antecedent discharge, which had ceased before the dogs came under our observation. We consequently examined the dogs in which the growth was in an early stage. In no case did we find any purulent discharge.

In the case which we successfully inoculated the growths were not preceded by discharge.

¹ Journ. Path. and Bacteriol., Edin. and London, July 1896.

The owner from his own observations states that the growths are unattended with any purulent discharge. The first thing noticed in the bitches was a slight sanguineous discharge some time after being served; and, unless the growths were specially looked for, this bleeding was the first evidence of their existence.

Treatment.—After watching the results of various modes of treatment, we have no hesitation in saying that, when possible, the tumours should be excised. In most cases this is readily accomplished by snipping the mucous membrane around the base of the tumour, and stripping it off with the attached growth from the underlying tissues. Some vessels may require ligation, and the edges of the mucous membrane may then be brought together with a few stitches. We have operated in this way upon six occasions, and there has been no recurrence of the growths. In one case it was necessary to divide the perinæum, in order to get at a large mass of growth 3 inches in diameter, situated on the anterior wall and the sides of the vagina. The perinæum was then sewn up, and the mucous membrane, as far as possible, loosely brought together with stitches. The wound healed well, and there has been no appreciable contraction of the outlet.

When the growth has infiltrated the vaginal wall the only possible method of treatment is by excision of the part of the vagina affected. In one case we excised about 4 inches of the vagina, but without success, death apparently resulting from a chronic affection of the kidneys. Partial removal by tearing away the tumour with forceps is useless, and only leads to a rapid extension of the growth.

The destruction of the growth by the use of caustics is a long and troublesome process, and unsatisfactory in the extreme. Much cicatricial tissue forms, contracting the lumen of the tube; and even after the prolonged use of caustics it is difficult to be certain of a complete cure.

Inoculation Experiments.—We have not yet completed our inoculation experiments, so that we will only mention briefly the main results. We hope at a later date to publish a full and detailed account.

Attempts to infect rabbits and guinea-pigs have completely failed.

A dog which was inoculated on the penis developed a typical growth which, after some months, had reached the size of a marble.

A minute portion of a tumour removed from the vagina of a bitch was placed in the subcutaneous tissue of the abdomen of a dog. In a fortnight a distinct, nodulated, well-defined tumour, half an inch in diameter, had appeared in the subcutaneous tissue at the seat of inoculation. The tumour gradually increased in size, and at the end of two months the animal was killed by chloroform. At the *post-mortem* examination a well defined nodulated tumour, $1 \times \frac{1}{2}$ inch, was found in the subcutaneous tissue. On section it had a pinkish-white appearance, and a microscopical examination revealed the same structure as the rest of the growths.

In another case, after inoculation into the peritoneal cavity, a nodule appeared in the abdominal scar. At the end of two months this nodule formed a projecting lobulated mass, $1\frac{1}{4}$ inches long, and

$\frac{3}{4}$ inch broad. A month later the tumour had almost completely disappeared, and the animal was killed.

At the *post-mortem* examination a nodule the size of a pea was found imbedded in scar tissue.¹

Remarks.—There seems to be no doubt that the tumours in question are of the same nature as those described by veterinary surgeons under the names of condylomata, papillomata, or warts; but we cannot find in veterinary works any account of microscopical appearances, nor any suggestion of infectivity.

They also appear to be identical with the tumours described by Wehr, Geissler, and by Duplay and Cazin, in their experiments upon the infectivity of cancer; so that we think it well to give a short abstract of their work.

Geissler² was successful in inoculating from a cauliflower-like tumour occurring on the prepuce of a dog. The tumour consisted of an alveolar framework enclosing masses of polymorphous cells which were closely packed together in some alveoli, and loosely packed in others. Although he considered the tumour to be carcinomatous, he stated that it differed in structure from the typical carcinomata found in the human subject. In the discussion which followed his paper the general expression of opinion was that the growth was not a carcinoma, but that it consisted of a mixture of granulomatous and sarcomatous tissue.

He inoculated a series of dogs with pieces about the size of a millet seed, taken from the deeper part of the tumour, and in two cases the inoculation proved successful.

A bitch was inoculated in the subcutaneous tissue of the abdomen, the material being pushed into the deeper part of the tissue by means of a trocar and canula. In three weeks a tumour the size of a plum formed, but it ultimately disappeared. Portions of the tumour removed during life showed the same structure as the original growth.

A dog was inoculated in the same way in the subcutaneous tissue of both flanks, and also in the cavity of the tunica vaginalis. In five weeks a tumour appeared in each of the three places. One of the tumours in the flank ulcerated. The animal died at the end of eight months. At the *post-mortem* examination six tumours, each about the size of a bean, were found in the wall of the thorax; some were adherent to skin, and others freely movable. In the linea alba two ulcers with indurated bases were found, the one $6\frac{1}{2} \times 3\frac{1}{2}$ cm., and the other $2\frac{1}{2} \times 1\frac{1}{2}$ cm. In the scrotum there was a tumour about the size of a pea adherent to the skin, but freely movable over the underlying tissue. On the left side of the prepuce there was a hard swelling adherent to the skin, but movable over the penis. The lymphatic glands all over the body were enlarged, especially those in the neck. Many small secondary deposits were found in the skin over the inner side of the thigh. On opening the abdomen the left spermatic cord was thickened, and contained a tumour about the size of a cherry, compressing the ureter. There were many small nodules in the spleen, liver, and peritoneum. On the parietal pleura there was a villus-like growth. Unfortunately, on account of an accident with the preserving fluid, no microscopical examination was made of

¹ The inoculation experiments upon dogs were kindly performed for us by Professor Bradford.

² "Verhandl. d. Deutschen Gesellsch. f. Chir.," 1895.

the secondary deposits, and consequently their real nature remains doubtful. A portion of one of the tumours at the seat of inoculation was removed during life, and showed the same structure as the original growth. With this portion of tumour a third dog was successfully inoculated; and at the time of publication of his paper the resulting tumour was still increasing in size.

Wehr¹ made a series of inoculations with what he considers undoubted carcinomata. The tumours in question affected the prepuce and the vestibule of the vagina of dogs in the form of papillomatous, cockscomb-like, soft, medullary growths. He states that they are similar to the growths described by veterinary surgeons as condylomata. Histologically they consisted of a scanty stroma, containing many cells with round nuclei closely pressed together.

Altogether he inoculated twenty-six dogs in the subcutaneous tissue, using the same method as Geissler. In most of the cases tumours appeared at the spot of inoculation, but disappeared in six or eight weeks. Portions of some of the tumours removed during life showed the same structure as the original growth.

In the case of one bitch, which was inoculated in four places, death ensued at the end of seven months. At the *post-mortem* examination, in addition to a tumour the size of a plum at the site of inoculation, there was a tumour the size of an apple in the retro-peritoneal glands on each side of the vertebral column, compressing the urethra, and causing rupture of the bladder. There were two enlarged glands in the thorax, and a few scattered nodules in the spleen. Wehr states that these secondary deposits were of a carcinomatous structure.

Duplay and Cazin² made an extensive series of inoculations in order to study the infective nature of tumours. In all cases of undoubted malignant growths the results were negative. They, however, performed successful transplantations to the genitals of dogs from a growth the size of a walnut occurring in the vagina of a bitch. They state that the microscopical character of the tumour resembled inflammatory rather than carcinomatous tissue. The tumours which developed after inoculation were about the size of hazel-nuts, and were of similar structure to the original growth. In one of the successful cases there was found, in addition to a tumour on the penis, at the site of inoculation a deposit of an epithelial character in the testis. They, however, consider it possible that this deposit bore no causal relation to the inoculation.

The tumours described by all these observers resemble those in our series, both in their situation on the genitals of dogs and in their naked-eye appearances. From the descriptions given we believe, too, that they are similar in microscopical structure. We differ, however, in our views about the nature of the tumours. Duplay and Cazin say that the structure resembles inflammatory rather than carcinomatous tissue. Geissler and Wehr consider the tumours to be carcinomata. We have already stated that whilst the alveolar arrangement of polyhedral cells in some of the tumours may suggest at first sight an epithelial new formation, there is nothing in the microscopical structure of the tumours, either at an early or at a late stage, to distinguish them from ordinary round-celled sarcomata.

¹ "Deutscher Chir. Cong.," 1888 and 1889.

² Trans. Eleventh Internat. Med. Cong. in Rome, vol. ii., p. 103.

Both Geissler and Wehr noticed that in some cases tumours which had developed after subcutaneous inoculation, ultimately disappeared, although portions of these tumours, when removed, showed the same structure as the original growth. This agrees with our own experience above quoted.

Geissler and Wehr appear to have been successful in obtaining secondary deposits in the viscera. We have, up to the present, no conclusive evidence of the occurrence of secondary deposits in the organs; but the infiltration of the deeper tissues in two of the cases, and the affection of the glands in one case, show that the tumours are capable of assuming a malignant course.

Conclusions.—1. The tumours we have described affect the genitals of dogs, and are probably identical with the papillomata, condylomata, and warts of veterinary surgeons, and with the infective tumours described by Geissler, Wehr, and by Duplay and Cazin.

2. The contagion is conveyed during the act of coitus, and the tumours are not dependent upon the irritation of any discharge.

3. The tumours can be transplanted artificially, not only to the mucous membrane of the genital organs, but also to the subcutaneous tissue.

4. The muscular wall of the vagina may be infiltrated, and secondary deposits may occur in the lymphatic glands.

5. The clinical identity of the infiltrating tumours and the simple outgrowths is shown by the case in which a bitch with an infiltrating tumour infected a dog with multiple simple outgrowths.

6. The structure of the tumours is identical with that of a round-celled sarcoma.

7. The tumours which have developed in the subcutaneous tissue after inoculation may disappear in the course of a few months.

ANTHRAX.

By J. M'FADYEAN, Royal Veterinary College, London.

Definition.—Since the discovery of the anthrax bacillus and the demonstration of its pathogenic properties, it has been possible to give an exact definition of the disease which is now generally known in this country under the name of anthrax. That word must now be reserved for the malady which is caused by the anthrax bacillus. Every case of disease determined by that organism—no matter what may be the symptoms manifested or the lesions induced—must be called anthrax, and no case of disease that has any other cause must be so named, no matter how closely it may resemble a case of anthrax in respect of symptoms and lesions.

Furthermore, it is very undesirable that the word anthrax, even when qualified by an adjective, should be applied to morbid conditions that are etiologically distinct from the disease caused by the anthrax bacillus. On this account the use of the words anthracoid and symptomatic anthrax ought to be avoided. The first of these is as meaningless as “glanderoid” or “tuberculoid,” and the latter tends to promote confusion by suggesting a relationship between two diseases that are etiologically quite distinct.